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ABSTRACT

This paper defines concepts relating to institutional-productivity-models, lists components of a productivity-policy-model, and discusses several models. An institutional-productivity-policy-model is a manipulative representation of the productivity of an institution or part of an institution. Components of an institutional-productivity-policy-model are: specification of both the numerator and denominator of the productivity ratio being used; a list of possible actions that will affect the institution's productivity; and a law of change, indicating the effect on productivity that can be expected to result from each of the various possible actions. The traditional faculty productivity model and a behavioral student/faculty productivity model (after Kirschling and Staaf) are described. (SW)

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A NOTE ON POLICY IMPLICATIONS OF SOME INSTITUTIONAL-PRODUCTIVITY MODELS

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I DEFINITIONS

Productivity

Productivity, by itself, is a meaningless term. To be meaningful it must be ascribed to an activity, and, in particular to a productive activity, which can be defined as one that uses up resources and puts out product. Productivity is a measure of how much product is put out in relation to how much resources are used up. The productivity of an activity, if it can be measured at all, must be expressed as a ratio of product put out to resources taken in.

Institutional-productivity

Institutional-productivity refers to the productivity of an institution or part of an institution, viewed as a productive activity, that is, a consumer of resources and a producer of products.

Model

A model may be defined as a manipulative representation of an activity; where "manipulative" means that the quality of one or more essential parts of the representation is, by intent, changeable. Thus a painting is not a model, because, although it may be switched from wall to wall, or wall to closet, location is not an essential part of a painting, and essential parts such as the color scheme are not intended by the painter to be manipulative. The manipulative nature of a model is revealed when questions such as "What would happen if the value of x is changed from x_1 to x_2?" make sense, and the answer is presumed to lie in the manipulation of the model.

Institutional-productivity-model

An institutional-productivity-model is a manipulative representation of the productivity of an institution or part of an institution. For example, if resource intake is expressed in terms of the cost of the resources consumed, and product output in terms of the number of student credit hours produced, an institution's productivity, P, might be expressed by the ratio

$$P = \frac{\text{Number of student credit hours}}{\text{Cost}} ,$$

which can be used to observe, for example, the effect on productivity of reducing cost while holding student credit hours constant. Of course, such a ratio is likely to reflect reality only approximately, and then only over short ranges of the numerator and denominator.

Or, if the number of student credit hours produced per faculty contact hour is of interest, faculty contact hours may be considered as an intermediate product, that is, both output from and intake to the activity, as follows:

$$P = \frac{\text{Faculty contact hours}}{\text{costs}} \cdot \frac{\text{Student credit hours}}{\text{Faculty Contact hours}}$$

which can be used to observe, for example, the effect on P of holding faculty contact hours constant while increasing costs (salary hike) while also varying student credit hours produced per faculty contact hour (larger or smaller classes and/or higher/lower pass/fail ratios).

Policy

A policy is a set of rules for making decisions, where a decision may be defined as the selection for execution of a particular action from among alternative actions, for the purpose of eventually achieving a goal or attaining an objective.

Policy-model

A policy model is a model designed to aid decision-making in connection with some activity. Policy models show what can be expected to happen when certain actions are taken; or as George Stigler puts it, " . . . . the relationship between policies and the results of policies." (pg. 2)

Institutional - productivity - policy - model

An institutional - productivity - policy - model is a policy model used in making decisions concerning the improvement of an institution's productivity.

II. COMPONENTS OF AN INSTITUTIONAL - PRODUCTIVITY - POLICY - MODEL

1. Specification of both the numerator and denominator of the productivity ratio being used.
2. A list of possible actions that will affect the institution's productivity.
3. A law of change, indicating the effect on productivity that can be expected to result from each of the various possible actions.

II. SOME INSTITUTIONAL - PRODUCTIVITY - POLICY - MODELS

*** THE TRADITIONAL FACULTY PRODUCTIVITY MODEL

1. Specification of the productivity ratio:

$$P = \frac{\text{Number of student hours produced}}{\text{Number of faculty contact hours used up}}$$

2. Possible actions for increasing productivity:

   (a) Increase class size

   (b) Introduce educational technology

3. Law of change:

   (a) Increase class size

   A relationship between student credit hours and class size is needed. This relationship might be quite simple if student credit hours are taken to mean enrolled student credit hours, in which case productivity would appear to increase directly with class size: Double the class size, doubles the productivity.

   However it is reasonable to assume that the quality of education diminishes as class size is increased, and at some point the effect of diminished quality will overshadow the effect of increased quantity.

   The productivity measure could take this into consideration by defining the numerator as student credit hours passed, or weighting the student credit hours by grades received, under the assumption that for overly large classes, the number of failures and low grades will demonstrate that smaller classes would have produced more absolute learning.

   (b) Introduce educational technology

   A relationship between faculty contact hours and educational technology is needed. Although technology is to some degree substitutable for faculty contact, the relationship may be quite complex particularly at the extreme of all technology and no faculty contact. Also in what units should educational technology be measured? The only unit that makes sense is cost and if

cost is used, then a relationship is needed to show how investment in educational technology can reduce the cost of faculty contact hours, and the denominator of the productivity ratio would have to be changed to reflect the cost of faculty contact hours rather than their number.

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The law of change for the traditional faculty productivity model is inadequate for decision making concerning class size and/or the introduction of educational technology.

A BEHAVIORAL STUDENT/FACULTY PRODUCTIVITY MODEL (After Kirschling and Staaf)

Consider a one semester course, with a professor and a class of students. Assume that the students from a homogeneous group, that is, each brings to the course about the same level of competence in and about the same degree of aptitude for the subject as the others.

Specification of the productivity ratio:

The course may be looked at as a productive activity with student and professiorial efforts the intakes, and student achievement the output:

$$P = \frac{\text{Student Achievement}}{\text{Student effort + Professorial effort}}$$

One problem with this ratio is that although the professor puts something in to the activity, he doesn't take anything out, and therefore, might be inclined to put in very little.

Another problem is that productivity is likely to be highest at very low levels of achievement and effort. It is like sleeping: The first hour of sleep produces more rest than any of the subsquent hours.

However, just as it is impractical for a person to sleep every third hour, so it is impractical for students and professors to put in just a little effort in each of a lot of courses.

The foregoing productivity ratio is unsatisfactory because unreal situations will show the highest productivity. By noting that both students and professors get more satisfaction from specializing in selected fields of study than from studying/teaching a bit of everything, the following productivity ratio suggests itself:

$$P = \frac{\text{Student satisfaction + Professorial satisfaction}}{\text{Student effort + Professorial effort}}$$

In symbols,

$$P = \frac{S_s + S_p}{E_s + E_p}$$

Starting with the denominator, how can the effort put into this course be measured? Student effort can be measured in terms of the number of hours the students devote to this course. (Attending class, doing homework, etc). The professor's effort can be measured in terms of the number of hours he or she devotes to the course (Lecturing, preparing, grading tests, etc.)

What about the numerator? Taking a cue from Kirschling and Staaf's Student - Faculty Introduction Model (pp 76-81) the satisfaction the students get out of this course depends not only on how much time they devote to it but also on their aptitude for learning the subject matter plus the professor's ability to get the material across multiplied by the time he spends doing so.

$$S_s = (A_s + A_p \cdot t_p)t_s$$

The professor's satisfaction from teaching the course is a function not only of how much time he or she devotes to it but also of his or her teaching ability multiplied by the time the students spend learning from him.

$$S_p = A_p \cdot t_s)t_p$$

Possible actions for increasing productivity:

(a) Select students with high aptitude for this course.

(b) Select students with strong motivation to put in a lot of study time on this course.

(c) Take/teach more advanced courses instead of elementary courses.

(d) Select courses where the professor has high teaching ability.

(e) Select courses where the professor devotes a lot of effort to teaching.

Law of change

(a) Select students with high aptitude for this course. It is clear that this action will increase productivity by increasing student satisfaction output without requiring an increase in the effort by either party.

(b) Select students with strong motivation to put in a lot of study time in this course. It is not so clear that this action would increase productivity. Student satisfaction out-take would increase but student effort input would also increase. However, professorial satisfaction out-take would increase without a concomitant increase in professorial effort input.

(c) Take/teach more advanced courses instead of elementary courses. Assuming students in advanced courses have been screened for high aptitude whereas intoductory courses have no screening; advanced courses would have a higher productivity (everything else being equal)

(d) Select courses where the professor has high teaching ability.

Both students and professorial satisfaction out-take is increased without a change in effort.

(e) Select courses where the professor devotes a lot of effort to teaching.

It is not so clear that this action would increase productivity. Both student and professorial satisfaction out-take would increase but professorial effort would also increase.

Kirschling and Staaf develop other more sophisticated models including "An Extended Faculty Model" that is essentialy a model of the private market with its associated incentive systems.